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BCE-041

DIPLOMA IN CIVIL ENGINEERING (DCLE(G))/ DCLEVI

00050

Term-End Examination

June, 2014

BCE-041 : THEORY OF STRUCTURES – II

Time : 2 hours *Maximum Marks : 70*

Note : *Attempt question number 1 which is* ***compulsory*** *and any other* ***four*** *questions. Solve* ***five*** *questions in all. All questions carry equal marks. Assume suitable data wherever necessary and mention it clearly. Use of calculator is permitted.*

1. Choose the most appropriate answer from the given alternatives in questions (a) to (g) below. *7×2=14*

(a) In a singly reinforced beam if the permissible tensile stress in steel develops earlier than the permissible compressive stress in concrete, then the beam section is called

(i) Over reinforced section

(ii) Under reinforced section

(iii) Economic section

(iv) Critical section

(b) In Limit State Method of design, the design bond stress in case of deformed bars is more than that of plain bars by

(i) 10%

(ii) 20%

(iii) 40%

(iv) 60%

(c) The pitch of the helix in a circular column shall ***not*** be less than

(i) 100 mm

(ii) Three times the diameter of the bar of helix

(iii) 25 mm

(iv) Greater of (ii) and (iii)

(d) The percentage of reinforcement in case of a slab, when high strength deformed bars are used, shall ***not*** be less than

(i) 0·15

(ii) 0·20

(iii) 0·30

(iv) 0·12

(e) If the maximum compression reinforcement in a beam is p% of the gross area of the section of the beam, the value of p shall be

(i) 4

(ii) 3

(iii) 2

(iv) 1

(f) In Limit State Method of design of R.C.C. flexural members, the minimum strain in the tensile reinforcement at collapse shall ***not*** be less than

(i) $0{\cdot}3\% + f_y/1{\cdot}15\ E_s$

(ii) $0{\cdot}2\% + f_y/1{\cdot}5\ E_s$

(iii) $0{\cdot}2\% + f_y/1{\cdot}15\ E_s$

(iv) None of these

(g) In Limit State Method of design, the characteristic strength of concrete is denoted by f_{ck}. The design stress in concrete at collapse (f_d) is taken as

(i) $0{\cdot}36\ f_{ck}$

(ii) $0{\cdot}42\ f_{ck}$

(iii) $0{\cdot}67\ f_{ck}$

(iv) $0{\cdot}45\ f_{ck}$

2. An R.C.C. rectangular beam of width 250 mm and overall depth 500 mm is reinforced with 4 bars of 20 mm diameter. Check whether the beam section is under reinforced, over reinforced or balanced. Also calculate safe moment of resistance for the beam. Given that :

Nominal cover = 20 mm

Diameter of shear reinforcement = 8 mm

Permissible stress in concrete in compression bending $\sigma_{cbc} = 7\ N/mm^2$

Permissible stress in steel in tension $\sigma_{st} = 230\ N/mm^2$

Modular ratio m = 13 *14*

3. (a) Mention the basic assumptions made in the theory for the design of reinforced concrete flexural members by Limit State Method. 7

(b) Draw the strain and stress diagrams for singly reinforced rectangular sections to be designed by Limit State Method. Determine the maximum depth of neutral axis for balanced section using grade of steel Fe 415. 7

4. Design a roof slab simply supported on all its four edges of effective span 3 m × 7 m. The top of the slab is provided with a 100 mm thick lime terracing. Imposed load may be taken as 1·5 kN/m^2. Design parameters are : nominal cover of 15 mm, f_{ck} = 20 N/mm^2 and f_y = 415 N/mm^2. 14

5. Design a column of unsupported length of 3·25 m effectively held in position but not restrained against rotation at both the ends. The column has a rectangular cross-section of 350 × 400 mm and carries a factored load of 2200 kN. Determine the area of longitudinal reinforcement to be provided in the form of 25 mm diameter bars. Design the transverse reinforcement also. The design parameters are : f_{ck} = 20 N/mm^2 and f_y = 415 N/mm^2 . 14

6. A rectangular beam of width 350 mm and an overall depth of 750 mm is subjected to a factored moment M_u = 200 kNm, factored torsional moment T_u = 140 kNm and a factored shear force V_u = 110 kN. Assuming an effective cover of 50 mm for both tension reinforcement and to anchor bars, concrete of grade M 25 and steel of grade Fe 415, design the shear reinforcement only for this beam. *14*

7. Write short notes on any ***four*** of the following : $4 \times 3\frac{1}{2} = 14$

   (i) Creep of concrete

   (ii) Limit state of serviceability

   (iii) Effective flange width of T-beams

   (iv) Necessity of a doubly reinforced section and its moment of resistance

   (v) Types of staircase

   (vi) Splicing of reinforcement